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Model DH500™
HYGRO-THERMOMETER

User Manual

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INTRODUCTION

Congratulations on your purchase of a DH500 Digital Thermo-Hygrometer! You now own one of the most accurate, reliable, and highly regarded temperature and humidity measurement instruments available today.

Pacer's model DH500 digital thermo-hygrometer is a versatile instrument for measuring temperature and humidity in various applications such as HVAC, indoor air quality studies, industrial process control, and research.

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Warranty

This product is fully warranted against defective materials and/or workmanship for a period of one year after purchase, provided it was not improperly used. For your protection, please use this product as soon as possible. If returned, it must be securely wrapped, sent prepaid and insured to:

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Keene, New Hampshire 03431
USA

Please include a note with name, address, telephone number and description of the problem. Although we provide assistance on Pacer products both personally and through our literature, it is still the total responsibility of the customer to determine the suitability of the product for use in their application.

This manual is provided by Pacer Instruments without any kind of warranty. Precautions have been taken in accurately preparing this manual; however, we neither assume responsibility for any omissions or errors that may appear nor assume liability for any damages that result from the use of the products in accordance with the information contained in the manual.

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SECTION 1 - SPECIFICATIONS

Ranges
Relative Humidity (%RH): 5.0 to 95.0 %RH

Temperature (using combination HTP202 probe): -4° to 176°F (-20° to 80°C)

Temperature (using optional RTD probe): -148° to 1112°F (-100° to 600°C)

Dew Point: Calculated for full range of HTP202 probe

Accuracy
Temperature: ±(0.3°C + 0.2% of reading in °C)
Temperature accuracy examples: ±0.3°C at 20°C
±0.5°F at 68°F
Relative Humidity: ±2.0 %RH
Dew Point: ±1.1°C (±2.0°F)

Resolution
Temperature: 0.1°F or °C (1°F below -99.9°F)
Relative Humidity: 0.1 %RH

Response Time
Relative Humidity: Up to 90% of change in measured value in 15 seconds
Temperature: Approx. 60 seconds in still air
Approx. 10 seconds in moving air streams

Display
0.5" LCD, 4 digits, with LED backlight

Operating Temp
Instrument: 32° to 125°F (0° to 50°C)
HTP202 Probe: -4° to 176°F (-20° to 80°C)

Power Supply
3 AA alkaline batteries

Battery Check
Automatic low battery display

Battery Life
Approximately 150 hours, without backlight

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Instrument Options Available

- Protective Rubber Boot and Splash-Proof Seal
- USB communications
- RS232 communications
- Analog 0-5 Volt output
- Custom cable lengths
- Immersion RTD temperature probe
- Surface RTD temperature probe
- Air RTD temperature probe

Included:

- (1) DH500 Instrument
- (1) HTP202 combination RH / temperature probe
- (3) Size AA 1.5 V alkaline batteries
- (1) Hard-shell carrying case with foam liner
- (1) DH500 Operation Manual

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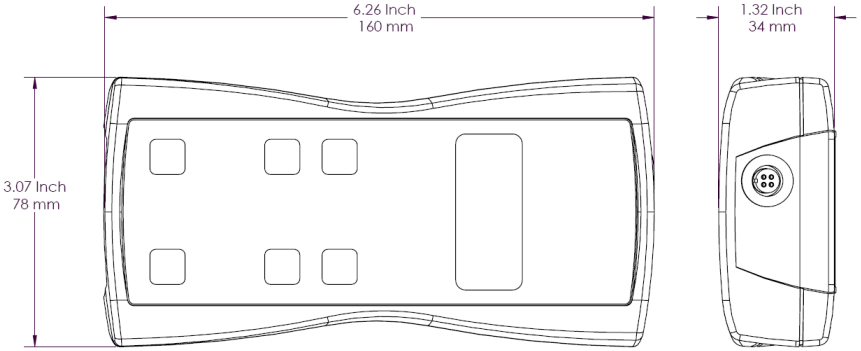
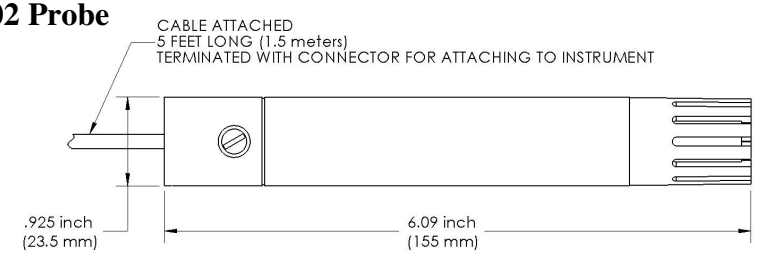
Dimensions

Instrument



HTP202 Probe



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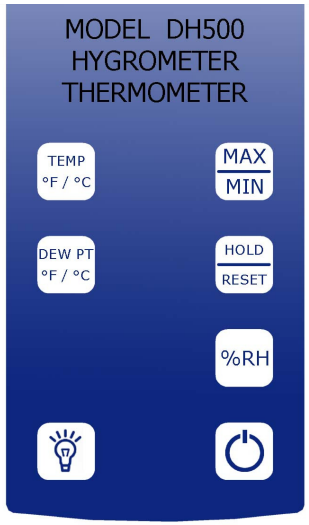
SECTION 2 – SWITCH FUNCTIONS



Pressing the ON/OFF key switches the instrument ON. Hold down the key for 2 seconds to switch the unit OFF. The unit will automatically power off after 30 minutes without any key presses. To disable auto power-off, hold down the power button during turn-on. The unit will flash AOFF, which means that the auto power-off has been disabled. The auto power-off is re-enabled each time the instrument is turned on.

Press the BACKLIGHT key to turn the LCD backlight on for 30 seconds. To turn the backlight on permanently, hold the backlight key down for 3 seconds. The LCD will flash. The backlight is now switched on permanently. To switch the backlight off, press the backlight key again.

%RH

Press the PERCENT RELATIVE HUMIDITY key to display the percent relative humidity in the ambient air as measured by the HTP202 Combination Probe. **%RH** will be displayed along with the reading.

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TEMP °F / °C

Press the TEMPERATURE key to display the current temperature of the ambient air as measured by the HTP202 Combination Probe. To switch the units between degrees Fahrenheit (°F) and degrees Celsius (°C), press the TEMPERATURE key again. Either **°C** or **°F** will be displayed along with the reading.

DEW PT °F / °C

Press the DEW POINT key to display the current dew point of the ambient air. The value of the dew point is automatically calculated based on the ambient temperature and humidity measured by the HTP202 Combination Probe. To switch the units between degrees Fahrenheit (°F) and degrees Celsius (°C), press the DEW POINT key again. Either **°C** or **°F** will be displayed along with **DEW PT.** and the reading.

MAX MIN

Press the MAX/MIN key to record and display the maximum reading. The maximum reading display will alternate with the letter "H" displayed with the number 2, which indicates that you're taking readings every two seconds. Press the MAX/MIN key again to record and hold the minimum reading. The minimum reading display will alternate with the letter "L" displayed with the number 2.

To exit MAX/MIN mode, press any key.

HOLD RESET

Press the HOLD/RESET key to freeze the current reading on the display. **HOLD** is displayed on the LCD and the reading is held.

Press the HOLD/RESET key a second time to clear this mode and return the unit to normal operation.

Press the HOLD/RESET key while in MIN/MAX mode to display BOTH the minimum and maximum readings since the MAX/MIN key was pressed. Once the HOLD/RESET key is pressed while in MAX/MIN mode, new readings are no longer recorded. To return to MAX/MIN mode, press the HOLD/RESET key again.

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SECTION 3 – OPERATIONAL NOTES

9009 **- Out of Range Error:** If the HTP202 probe is exposed to temperatures or humidity levels outside of its range (see Section 1 – Specifications), the instrument will display 9009. This is the out-of-range error. This error will also be displayed if the instrument is turned on without the HTP202 probe attached.

The humidity sensor will not read correctly if it is exposed to condensation. If the HTP202 probe is stored in a cold environment and is then exposed to a warm, humid environment while the probe is still cold, condensation will form on the humidity sensor. The humidity reading is invalid until the condensation has evaporated completely.

Both the humidity and temperature sensors will have a faster response time if they are exposed to a moving air stream. This is because forced convection will cool or heat the sensors faster than free convection.

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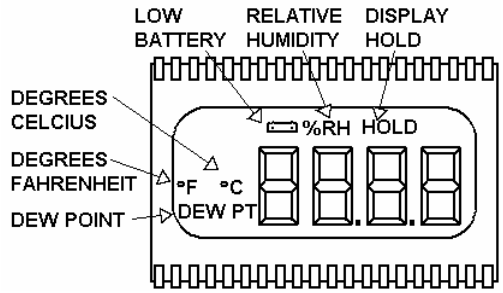
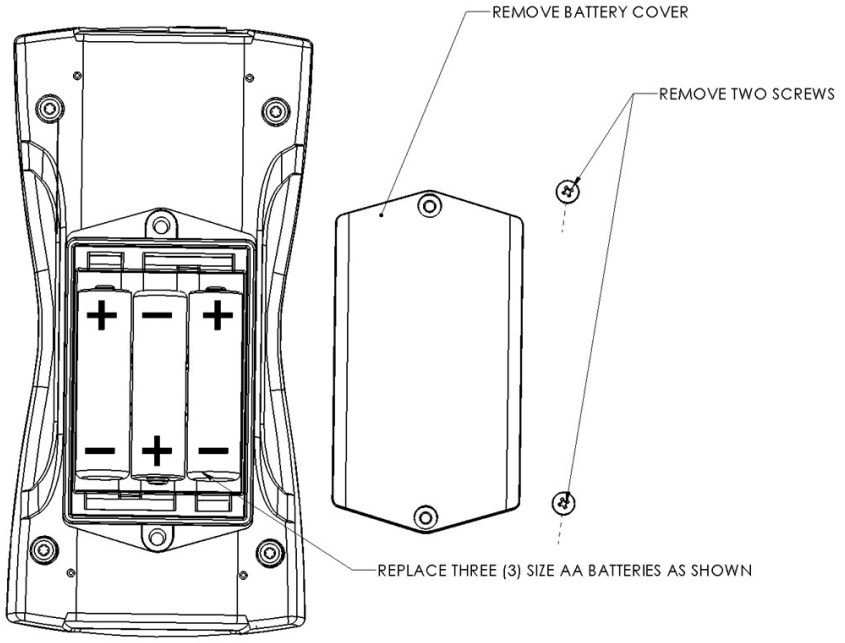
APPENDIX A – LCD DISPLAY SYMBOLS



APPENDIX B – BATTERY REPLACEMENT



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APPENDIX C – ANALOG OUTPUTS (IF EQUIPPED)

If the instrument is equipped with the analog output option, there will be a five-pin connector on the bottom of the instrument. Also, an analog output cable will be included with the instrument. This cable will have a five-pin connector on one end and four tinned wires on the other end.

The instrument will output a Voltage between 0 and 5 Volts that corresponds to the Temperature and Relative Humidity measured by the instrument. The output ranges, pin assignments, and wire colors are given in the table below. Also shown is a block diagram of the analog output circuit.

Wire Color	Pin #	Function	Analog Output Voltage Range	Corresponding Measurement Range	Equation to convert from Volts (*V*) to Measurement Value
BLK	1	Ground	--- N/A ---	--- N/A ---	--- N/A ---
GRN	2	--- Not Used ---	--- N/A ---	--- N/A ---	--- N/A ---
GRY	3	% Relative Humidity	0 to 5 Volts	0 to 100 %RH	Relative Humidity [%] = 20×*V*
WHT	4	Temperature	0 to 5 Volts	-20°C to 80°C	Temperature [°C] = 20×*V* - 20

*To convert from Volts to Percent Relative Humidity (%RH), multiply by 20.

- ► For example, an analog output of 3.722 Volts on the gray wire means that the instrument is measuring a relative humidity of 74.44 %RH.
- ► 3.722 Volts × 20 = 74.44 %RH

*To convert from Volts to Temperature in degrees Celsius (°C), multiply by 20 and subtract 20.

- ► For example, an analog output of 3.458 Volts on the white wire means that the instrument is measuring a temperature of 49.16 °C.
- ► 3.458 Volts × 20 – 20 = 49.16 °C

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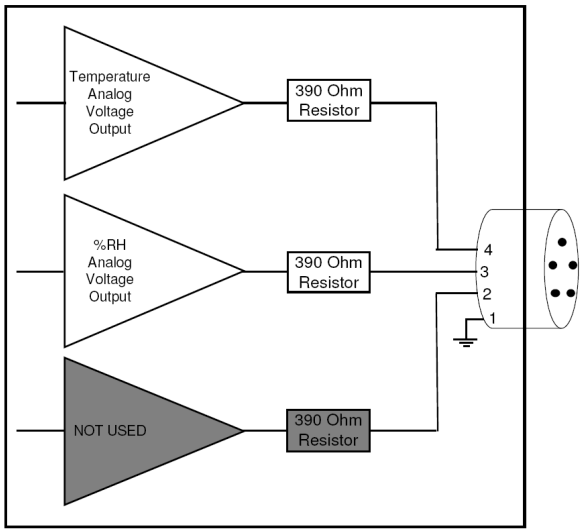
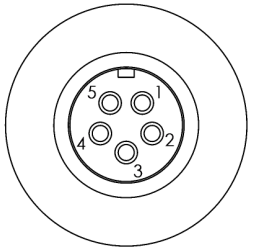
Note: When using analog outputs, there is an **additional ±1% error** in the analog output voltage. This is in addition to the normal measurement error.

- ► For example, an air velocity reading of 500 FPM would normally have an accuracy of ±1% of reading ±1 digit (±6 FPM) when the data is viewed on the LCD display.
- ► With the additional error associated with the analog output voltage, the effective accuracy of the analog output for this air velocity measurement will be ±2% of reading ±1 digit (±11 FPM).

Custom Analog Voltage Outputs are also available – contact Pacer for details.

Analog Output circuit block diagram and connector pin assignment





ANALOG OUTPUT CONNECTOR PINOUT DIAGRAM

Mating Cable Connector:
Binder Part No. 99-0413-00-05

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APPENDIX D - USB DATA OUTPUT (IF EQUIPPED)

If the instrument is equipped with the USB Communications option, there will be a four pin male connector on the bottom of the instrument. Also, a USB cable will be included with the instrument. This cable will have a four pin female connector on one end and a USB Type-A connector on the other end.

USB Data Output – Instructions for Use

STEP 1: Install a Virtual COM Port (VCP) Driver on your computer. Free VCP drivers can be downloaded for Windows, Linux, and MAC from FTDI Ltd on their website: http://www.ftdichip.com/Drivers/VCP.htm

We recommend downloading the setup executable, which automatically runs and configures the drivers for you.

STEP 2: Connect the USB cable (included) to the male connector on the bottom of your instrument. Connect the other end to a USB port on your computer.

STEP 3: Turn the Instrument ON.

STEP 4: Verify that the Instrument has been set up as a USB Serial Port with a unique COM port number. (You only need to do this once)

For Windows users, open the Windows Device Manager (found in Control Panel) and verify that a USB serial port exists as shown below.

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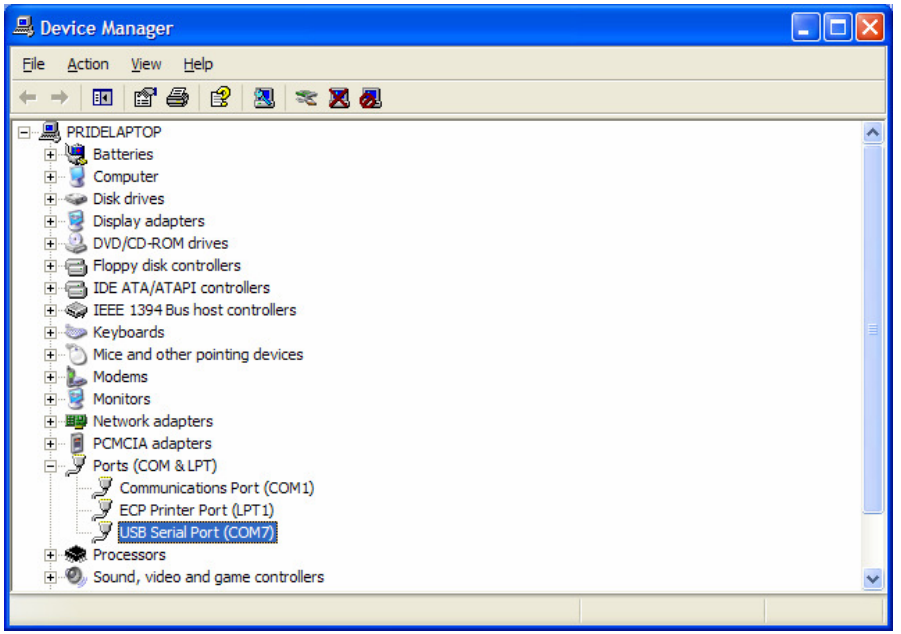

You are now ready to capture the data being measured by your instrument.

Please refer to **Appendix F – Viewing and Capturing Data** for further instructions.

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APPENDIX E – RS232 COMMUNICATIONS (IF EQUIPPED)

If the instrument is equipped with the RS232 Communications option, there will be a three pin male connector on the bottom of the instrument. Also, an RS232 cable will be included with the instrument. This cable will have a three pin female connector on one end and a DB9 Female connector on the other end.

RS232 Data Output – Instructions for Use

STEP 1: Connect the RS232 cable (included) to the female connector on the bottom of your instrument. Connect the other end to an RS232 port on your computer.

STEP 3: Turn the Instrument ON.

STEP 4: Verify that the Instrument has been set up as a RS232 Serial Port with a unique COM port number. (You only need to do this once). For Windows users, open the Windows Device Manager (found in Control Panel) and verify that a serial port exists.

You are now ready to capture the data being measured by your instrument.

Please refer to **Appendix F – Viewing and Capturing Data** for further instructions.

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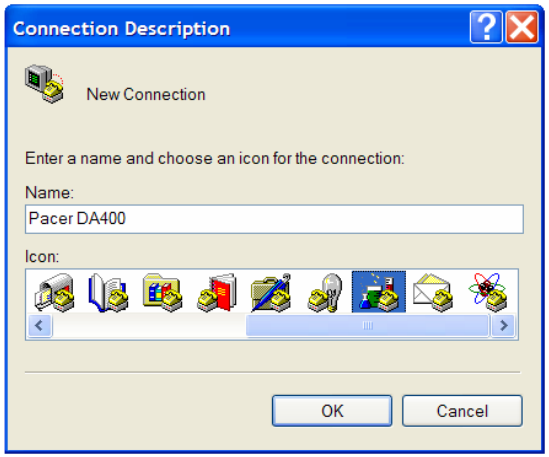
APPENDIX F – VIEWING AND CAPTURING DATA
(IF EQUIPPED WITH EITHER USB OR RS232 OUTPUTS)

There are many ways to capture the serial port data from the Pacer Instrument. The simplest method is to use a terminal emulator program.

Using a terminal emulator allows the serial COM port to be opened, with the above port settings, and real-time data to be viewed from the instrument. One such terminal emulator program is Windows HyperTerminal.

To launch Windows HyperTerminal, go to:
START → All Programs → Accessories → Communications → HyperTerminal

Enter a name for the Connection, such as “Pacer DA400” and choose an icon.



Click OK.

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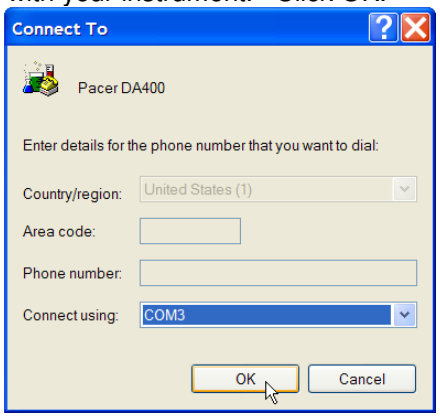
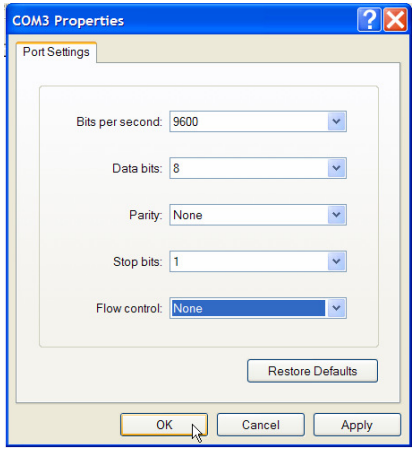
On the next window, next to "Connect using," select the COM port you that you are using with your instrument. Click OK.



In the next window, select the port settings as shown below and click OK. (The Serial Port settings are also listed at the end of this section).



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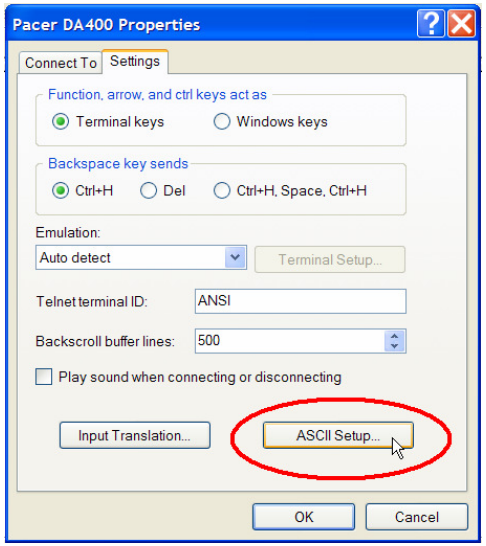
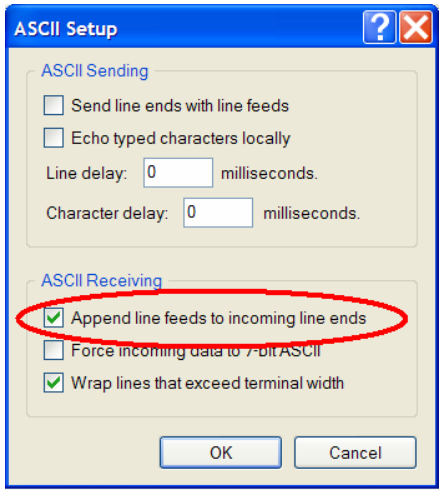
Click on File → Properties. You will see the window shown below. Click on the Settings tab and then click on ASCII Setup… as shown below.



Make sure that "Append line feeds to incoming line ends" is CHECKED as shown below. Click OK.



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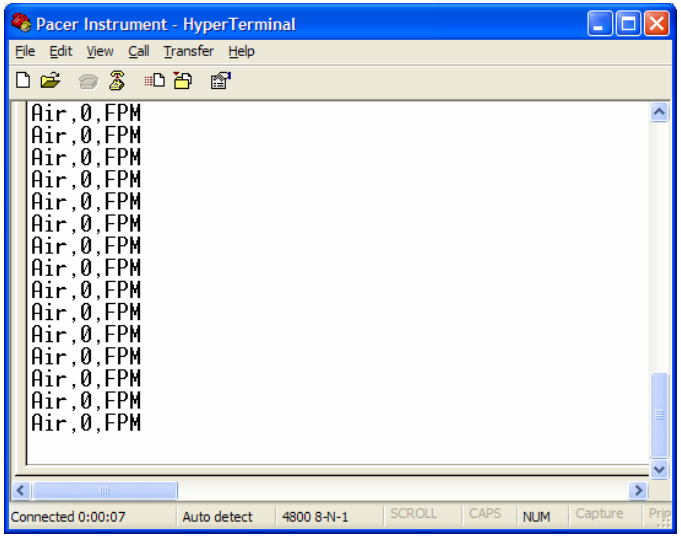
You will now receive data from your instrument. The graphic below shows the serial port output data from Windows HyperTerminal when connected to a Pacer DA400 Instrument.



Serial Port Settings

Bits per Second (Baud)	9600
Data bit	8
Parity	None
Stop bits	1
Flow Control	None

Serial Port Protocol

Data Output Interval	One Second
Data Format	Comma-Separated Values (CSV)
Measurement Units	Same as Units shown on LCD Display

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Below are examples of the formatted output data for Pacer's Premier Series Instruments (units may be different depending on the units selected on the LCD display):

Model DA400: Air,47,FPM <CR>

Model DA410 displaying in Air Velocity Mode: Air,47,FPM <CR>
Model DA410 displaying in Volume Flow Mode: Air,251,CFM <CR>

Model DA420: Air,47,FPM,Temp,56.7,C <CR>

Model DA430: Air,47,FPM,Temp,56.7,C,RH,40.5,% <CR>

Model DH500: Temp,56.7,C,RH,40.5,%,DewP,43.6,C <CR>

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Exporting and Graphing Data

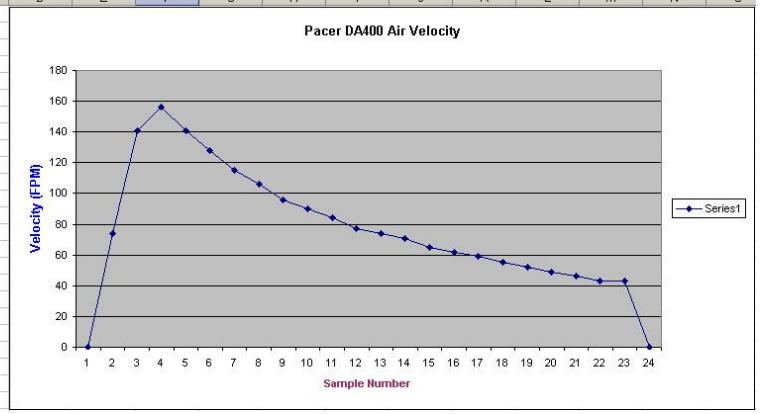
Exporting serial port instrument data from the Pacer Instrument to a spreadsheet application such as Microsoft Excel or OpenOffice Calc allows the data to graphed or recorded.

The simplest way to export the instrument data is to use a terminal emulator program, like Windows HyperTerminal, and either capture the serial data/text to a file (menu selection) or to manually highlight, copy, and then paste the instrument data into an editor such as Windows Notepad.

Once you have the instrument data in a file, save the file as a .CSV type (e.g., InstrumentData.csv).

Open the file in a spreadsheet application such as Microsoft Excel or OpenOffice Calc. A graph of the data as shown below can now be generated.

	A	B	C
1	Air	0	FPM
2	Air	74	FPM
3	Air	141	FPM
4	Air	156	FPM
5	Air	141	FPM
6	Air	128	FPM
7	Air	115	FPM
8	Air	106	FPM
9	Air	96	FPM
10	Air	90	FPM
11	Air	84	FPM
12	Air	77	FPM
13	Air	74	FPM
14	Air	71	FPM
15	Air	65	FPM
16	Air	62	FPM
17	Air	59	FPM
18	Air	55	FPM
19	Air	52	FPM
20	Air	49	FPM
21	Air	46	FPM
22	Air	43	FPM
23	Air	43	FPM
24	Air	0	FPM



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CALIBRATION

We recommend that our instruments are calibrated each year to keep them in top working order.

Our calibration services include ensuring the instrument performs within its accuracy tolerance, making any necessary adjustments, and inspecting all aspects of the instrument's functionality so that you'll have another year of dependable service. Calibration also includes a complimentary firmware upgrade so that you know you'll have the latest advances in accuracy and reliability in your instrument.

NIST-Traceable multi-point calibration is also available from the factory. We can offer precise calibration tailored to your specific measurement needs using our state-of-the-art facilities and calibration equipment.

Please contact us or visit our website for the latest information on calibrating your instrument.

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Notes:

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